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Quarterly Status Report

I have just returned from a six weeks oceanographic field-trip to the Red Sea on Research Vessel CHAIN. The purpose of this trip was to study the geochemistry and biology of hot brines, which occur at a depth of about 2000 meters in the center portion of the Red Sea Rift area. The brines occur in two deeps (about 10 miles long and 4 miles wide) and extend about 200 meters into the open ocean. Chemically they are characterized by a salinity ten times that of normal sea water, lack of oxygen, abundance of heavy metals, e.g. iron, zinc, manganese, copper, lead, a pH of 4.5 to 5.5, and a temperature of 60° C. The heavy metals are enriched to about 100,000 times the concentrations normally found in the oceans.

Shipboard determinations on the presence of microorganisms indicate the lack of both reducing and oxidizing bacteria within the brines. However, the polulation densities at the seawater-brine boundary were remarkably high. It is noteworthy that these bacteria could only be cultivated at temperatures exceeding 40°C.

The sediments underlying the brines are composed of more than 90% of heavy metal sulfides, carbonates, and oxyhydrates (iron-zinc-manganese-lead-copper). They also contain organic constituents, the origin of which is still uncertain. It is intended to study the biogeochemistry of these organic constituents, and to see what kind of relationship exists between the inorganic and organic compounds. Inasmuch as these reactions apparently proceed under sterile conditions, some insight may be gained as to similar reaction mechanisms that once were established in the early Precambrian Sea.

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Our studies on the polymerization of amino acids by the action of heavy-metal complexed clay minerals is progressing. We are presently preparing some of the clay-amino acid complexes for electron-microscope analysis. The instrument has been recently awarded to us by the National Science Foundation.

Egon T. Degens

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cc. Dr. Paul Fye